

TOTAL OZONE TIME VARIATIONS DURING THE SPRING REVERSALS IN THE
HIGH LATITUDINAL STRATOSPHERE OF THE NORTHERN HEMISPHERE DURING
THE 20th AND 21st SOLAR CYCLES

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The principal features of the thermodynamic regime of the stratosphere are governed by the development of the winter stratospheric low and the Aleutian and Atlantic heights. These are fed by the influx of the eddy energy transported into the stratosphere by the planetary waves. The intensity and variability of planetary waves and vortices associated with the waves determine the conditions of low-to-high latitudes ozone transport in the winter hemisphere. Note that the ozone distributions are zonally inhomogeneous.

Figure 1 shows the March 1984 and 1985 course of total ozone (TO) for the stations of Leningrad (Voeikovo, 60°N 30°E) and Markovo (60°N 170°E) and data of spring reversals (D) in Julian dates. Time variations of TO are out of phase at these stations. Voeikovo lies within the area affected by the stratospheric polar cyclonic vortex which blocks the inflow of ozone from low latitudes. Markovo lies within the area affected by the Aleutian high, which usually centres in temperate or subtropical latitudes; the circulation within this vortex stimulates latitudinal exchange. These two thermobaric systems form, as a rule, planetary waves with zonal wave number $n = 1$. Connections between TO and planetary waves variations are shown in Figure 2. Figure 2 presents the day-to-day course of TO as observed at Voeikovo during February-March 1985, besides the amplitudes of the planetary waves at 30 hPa 60°N are given. Variations of TO are practically in counterphase with planetary wave amplitude variations (KIDIAROVA and TARASENKO, 1987; KIDIAROVA and SCHERBA, 1986).

The planetary wave dynamics is affected by solar activity variations during solar cycles. The 20th solar cycle maximum was accompanied by decreases of stratospheric planetary wave amplitudes, the 21st cycle was accompanied by increases of amplitudes.

Tab. 1. January mean total ozone values for maxima of the 20th and 21st solar cycle (1968 and 1979, respectively).

| Station | 1968 | 1979 |
|-----------|------|------|
| Churchill | 459 | 364 |
| Resolute | 483 | 325 |
| Lervick | 403 | 322 |

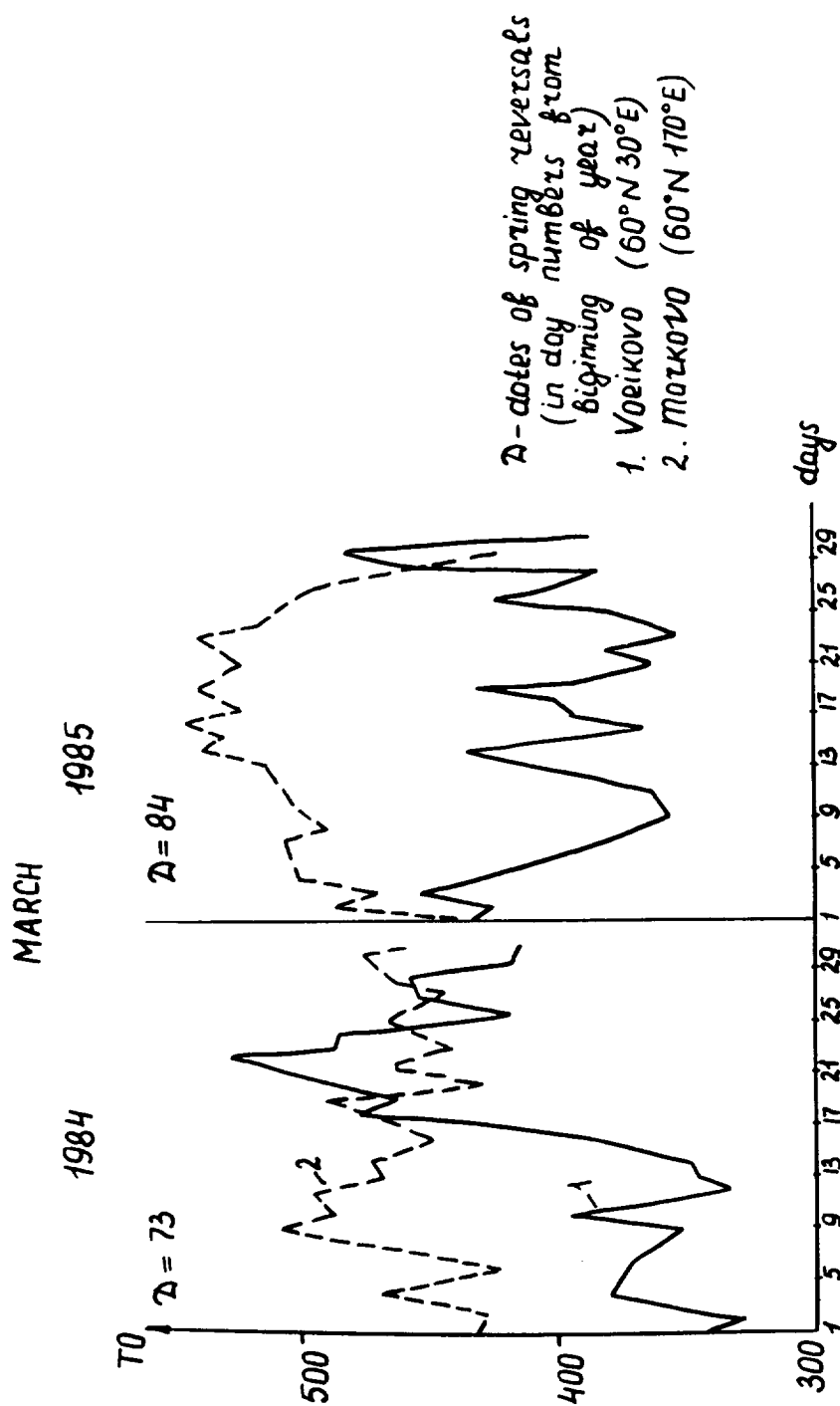


Fig. 1 Day-to-day course of total ozone (TO) at different longitudes

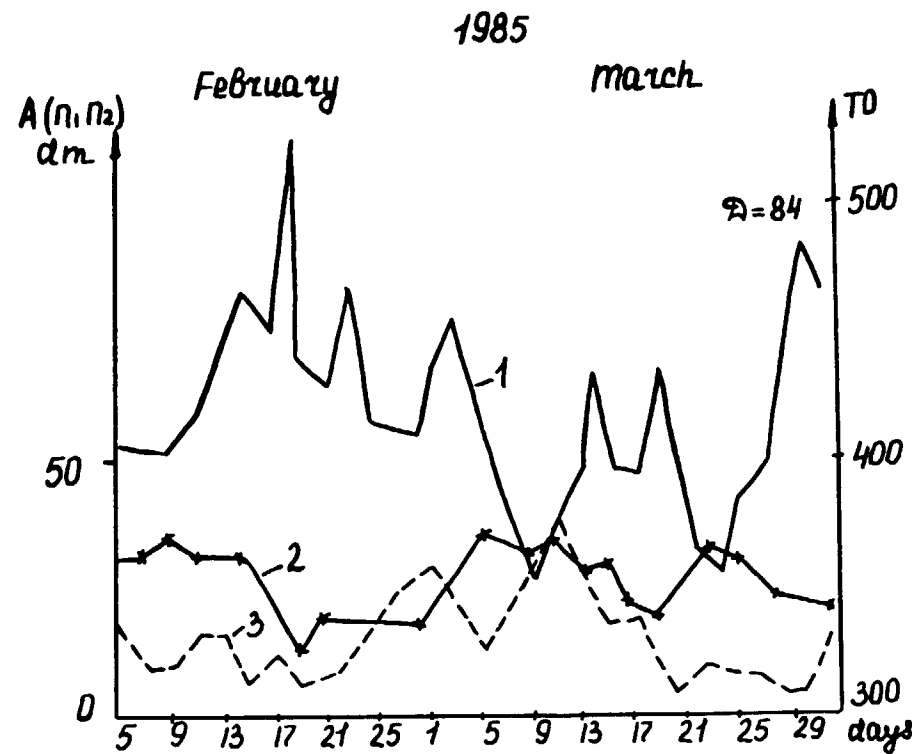


Fig. 2 Day-to-day course of total ozone (TO) at Voeikovo and amplitudes of planetary waves with $n=1$ and $n=2$ at 30 hPa 60°N for February and March 1985.

Tab. 2. Julian dates of spring reversals (D) and TO in Marches for the eastern (E) and western (W) phases of QBO during the 20th and 21st solar cycles.

| QBO phase | cycle 20 | | cycle 21 | |
|-------------|----------|-----|----------|-----|
| | E | W | E | W |
| Julian date | 88 | 98 | 97 | 89 |
| | | 10 | | |
| Churchill | 468 | 455 | 468 | 466 |
| Volikovo | 419 | 412 | 416 | 411 |
| Markovo | 474 | 432 | 472 | 452 |

REFERENCES

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- Kidiyarova V.G., and I.A. Scherba, Interannual variations of the planetary waves intensity and of the total ozone, Second All-Union Sym. on the Results and Middle Atmospheric Studies, Abstracts, 32, 1986 (in Russian).